U.S. Department of Transportation
Federal Highway Administration
Federal Lands Highway Office

PORTLAND CEMENT CONCRETE MIX DESIGN[1]
TRIAL BATCH SUMMARY

Project: _____ Date: _____

Contractor: _____ Concrete for: _____

Concrete producer: _____ Class of concrete: _____

_____ Mix designation: _____

• COMPRESSIVE STRENGTH (28 DAY)

Minimum average strength required [2] (f_{cr}) _____ psi

Design strength specified (f_c') _____ psi

• PROPORTIONS

Material	Specific Gravity (SSD)	SSD Wt. per y^3 (lbs)	Absolute Volume (y^3)	Tolerance % (±)
Cement	3.15	_____	_____	1
Water	1.00	_____	_____	1
Coarse aggregate	_____	_____	_____	2
Fine aggregate	_____	_____	_____	2
Total air			_____	
Other _____	_____	_____	_____	
Totals		_____ lbs	_____ ft^3	

Admixtures	Dosage per cy (oz)
Air entrainment	_____
Water reducer	_____
Retarder	_____
Color	_____
Accelerator	_____
Other _____	_____

• PROPERTIES

Water/cement ratio (by weight) _____

Measured unit weight _____ lbs/pcf

Theoretical unit weight _____ lbs/pcf

Measured air content _____ percent

Measured slump _____ inches

• MEASURED COMPRESSIVE STRENGTH

Individual 7-day psi _____ , _____ , _____ . Average (7 day): _____ psi

Individual 28-day psi _____ , _____ , _____ . Average (28 day): _____ psi

[1] For normal weight portland cement concrete (140-150 lbs/ft^3).
[2] See page 5.
[3] Bulk SSD.
[4] The water/cement ratio for modified concrete is the ratio of the weight of water to the combined weights of portland cement and cement substitute.

• SIGNATURES

Contractor: _____

Mix Designer: _____

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PORTLAND CEMENT CONCRETE MIX DESIGN[1] (Continued)
MATERIALS SOURCE SUMMARY

- **CEMENT (AASHTO M 85)**

Name and address of cement producer: _____

Source of manufacture: _____

_____

Type of cement: _____ Materials certification attached: ☐ Yes ☐ No

- **WATER (725.01 and AASHTO T 26)**

Water potable: ☐ Yes ☐ No If no, provide the following:

Water pH number	_____
Chloride concentration	_____(ppm)
Sulphate ion concentration	_____(ppm)
Total solids content	_____(%)

- **ADMIXTURES**

Material	Producer and Product Designation	Certification Attached	
		Yes	No
Air entraining admixture	_____	☐	☐
Water reducing admixture, type A	_____	☐	☐
Retarding admixture, type B	_____	☐	☐
Accelerating admixture, type C	_____	☐	☐
Water reducing and retarding admixture, type D	_____	☐	☐
Water reducing and accelerating admixture, type E	_____	☐	☐
Water reducing, high range admixture, type F	_____	☐	☐
Fly ash, type___	_____	☐	☐
Ground iron blast-furnace slag	_____	☐	☐
Silica fume (microsilica)	_____	☐	☐
Color additive	_____	☐	☐
Other: _____	_____	☐	☐

[1] For normal weight portland cement concrete (140-150 lbs/ft ^{3}).

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PORTLAND CEMENT CONCRETE MIX DESIGN[1] (Continued)
MATERIALS SOURCE SUMMARY

- **COARSE AGGREGATE (703.02 AND AASHTO M 80)**

Name of supplier/producer: _____

Location of material source: _____

Material type: ☐ Gravel ☐ Crushed gravel ☐ Crushed stone ☐ Crushed blast furnace slag

Grading no.: _____

Sieve Analysis:

Sieve Designation	Percent Passing	Specification
2 inch	_____	_____
1-1/2 inch	_____	_____
1 inch	_____	_____
3/4 inch	_____	_____
1/2 inch	_____	_____
3/8 inch	_____	_____
No. 4	_____	_____
No. 8	_____	_____
No. 16	_____	_____

Properties:

(1) Coal and lignite _____ (%) (0-0.5)[3]
(2) Deleterious chert _____ (%) (0-3)[3]
(3) Sodium sulfate soundness[2] _____ (%) (0-12)[3]
(4) Clay lumps and friable particles ____ (%) (0-2)[3]
(5) LA abrasion ____, grading ____, _____ % loss (0-40)[3]
(6) Bulk specific gravity _____
(7) Absorption _____ (%)
(8) Bulk SSD specific gravity _____
(9) Dry rodded unit weight _____ (lbs/pcf)
(10) Minus No. 200 _____ (%) (0-1)[3]
(11) Adherent fines _____ (%) (0-1)[3]
(12) Other _____

- **FINE AGGREGATE (703.01 AND AASHTO M 6)**

Name of supplier/producer: _____

Location of material source: _____

☐ Manufactured sand ☐ Natural sand ☐ Blend

Sieve Analysis:

Sieve Designation	Percent Passing	Accumulative Percent Retained
3/8 inch	_____	_____
No. 4	_____	_____
No. 8	_____	_____
No. 16	_____	_____
No. 30	_____	_____
No. 50	_____	_____
No. 100	_____	_____

Fineness modulus: _____

Properties:

(1) Clay lumps _____(%) (0-3)[3]
(2) Coal and lignite _____ (%) (0-1)[3]
(3) Sodium sulfate soundness[2] _____(%) (0-10)[3]
(4) Sand equivalent value, alt. 2 _____ (>75)[3]
(5) Bulk specific gravity _____
(6) Bulk SSD specific gravity _____
(7) Absorption _____ (%)
(8) Organic impurities _____
(9) Minus No. 200 _____ (%) (0-3)[3]
(10) Other _____

[1] For normal weight portland cement concrete (140-150 lbs/ft^3).
[2] At five cycles.
[3] Specification limits.

PORTLAND CEMENT CONCRETE MIX DESIGN[1] (Continued)
DATA FOR COMPUTING THE COEFFICIENT OF VARIATION OF BATCHES

Batch No.	Date Batched	7-Day Compressive Strengths (psi)				28-Day Compressive Strengths (psi)			
		Cyl. 1	Cyl. 2	Cyl. 3	Average ($\bar{x}$)	Cyl. 1	Cyl. 2	Cyl. 3	Average ($\bar{x}$)
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

[1] For normal weight portland cement concrete (140-150 lbs/ft^3).

$$\bar{X} = \frac{\sum X}{N} = \frac{\quad}{N} = \quad \text{(psi)} \qquad s = \sqrt{\frac{N \sum (X^2) - (\sum X)^2}{N(N-1)}} = \quad$$

Where:

$\bar{X}$ = The 28-day batch average of at least 2 cylinders (3 preferred).
X = The mean of the averages of 28-day compressive results.
s = The sample standard deviation of the 28-day batch averages.
N = The number of batches sampled.

PORTLAND CEMENT CONCRETE MIX DESIGN[1] (Continued)
DETERMINATION OF MINIMUM MIX DESIGN COMPRESSIVE STRENGTH

- **MINIMUM MIX DESIGN COMPRESSIVE STRENGTH (f_{cr})**

Computed values from page 4:

$\bar{X}$ = _____ (psi) s = _____

Where:

s = The sample standard deviation of the 28-day compressive strength test results from page 4.

$\bar{X}$ = The mean of the 28-day compressive strength test results from page 4.

V = The *coefficient of variation*[2] expressed as a decimal and calculated as follows:

$$V = \frac{s}{\bar{X}} = \frac{\quad}{\quad} = \quad \text{or } 0.15$$

$$f_{cr} = \frac{f'_c}{1 - kV} = \frac{\quad}{1 - 1.28 (\quad)} = \quad \text{(psi)}$$

Where:

f'_c = The 28-day design compressive strength specified in the contract.

k = A constant (1.28) for a probability that not more than 1 in 10 tests will fall below the specified compressive strength (f'_c).

[1] For normal weight portland cement concrete (140-150 lbs/ft^3).
[2] Use 0.15 for the coefficient of variation when there is insufficient test data available.

PORTLAND CEMENT CONCRETE MIX DESIGN [1] (Continued)
LABORATORY TRIAL BATCH MIX DESIGN SUMMARY

Description	Equivalent Batch Masses (SSD weight/y^3)				
Materials:	Batch 1	Batch 2	Batch 3	Batch 4	Batch 5
Cement (lbs)					
Water (lbs)					
Coarse aggregate (lbs)					
Fine aggregate (lbs)					
Air entrainer (oz)					
Water reducer (oz)					
High range water reducer (oz)					
Other _____					
Properties:					
Water/cement ratio					
Theoretical unit mass (lbs/pcf)					
Measured unit mass (lbs/pcf)					
Measured air content (%)					
Measured slump (inches)					
Ambient temperature (ºF)					
Concrete temperature (ºF)					
Measured Compressive Strengths (psi):					
Individual 7-day					
Individual 7-day					
Individual 7-day					
Average (7-day)					
Individual 28-day					
Individual 28-day					
Individual 28-day					
Average (28-day)					

[1] For normal weight portland cement concrete (140-150 lbs/ft^3).
[2] Measure slump values on concrete before and after addition of high range water reducer if used.